PATENT ABSTRACTS OF JAPAN

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(21)Application number : 04-134046

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(71)Applicant : FUJITSU LTD

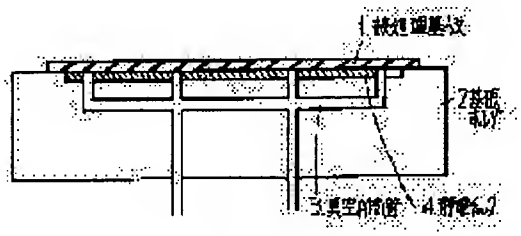
(72)Inventor : FUJIKAWA MICHIO

(54) FIXATION OF SUBSTRATE TO BE TREATED IN PLASMA TREATMENT EQUIPMENT

(57)Abstract:

PURPOSE: To prevent generated plasma from getting around into a rear face of a substrate to be treated during plasma treatment.

CONSTITUTION: Due to a vacuum exhaust pipe 3 which is installed in a substrate holder 2, a rear face of a substrate to be treated 1 is sucked and held in such a vacuum degree region that no plasma may be generated. In addition to vacuum suction and holding, an electrostatic chuck 4 is also used.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the fixed method of the processed substrate in plasma treatment equipment. In recent years, the improvement in dry etching technical [at large] is needed with the demand of high integration of LSI, and detailed-izing.
[0002] Therefore, also in the fixed method of the processed substrate in plasma treatment equipment, the cure in consideration of the influence of the plasma to the substrate is needed.
[0003]
[Description of the Prior Art] It is easy to produce imbalance in the fixed force of the processed substrate which is an anchorage-ed, and the electrode fixed side which is an adsorption fixed side, therefore between an anchorage-ed and an adsorption fixed side, a crevice is generated, plasma invades, and the fixed method of the processed substrate in [, such as the conventional plasma reaction chamber,] a vacuum has a bad influence by generation of heat and accumulation of the instability of the burnt deposits of a resist film, the abnormalities in a pattern, and a process tolerance etc.,
[0004] Moreover, to an etching rate, an ashing rate, or a membranous etching configuration, the electric field effect etc. produces the ununiformity of a control distribution, and gives a damage further to an electrical property.
[0005] Therefore, an electrostatic chuck fixed method is developed and the fixed method which used together the gas-cooling-method method and the electrostatic chuck method for cooling a processed substrate further came to be used.
[0006] Although, as for these fixed methods, the fixed force between an anchorage-ed and an adsorption fixed side is improved rather than the mechanical fixed method, since it is the method with which the adsorption power according [on a fixed method and] to an electrostatic chuck and **** by the gas cooling method consist of the force which works and conflicts, the life of an electrostatic chuck is short and secession of a processed substrate, the burnt deposits of a resist film, and the damages of a property often occur frequently.
[0007] Moreover, the short life of an electrostatic chuck is based on the damage of plasma. For this reason, the wraparound to the processed substrate of plasma becomes a big prevention factor to the development of process conditions which thinks as important especially the controllability of the detailed pattern which is also a future near technical problem.
[0008]
[Problem(s) to be Solved by the Invention] Therefore, it is necessary to prevent the invasion of the plasma of a between [an anchorage-ed and an adsorption fixed side] by vacuum adsorption in the field which plasma does not oscillate, and to remove evils, such as a physicochemical or electric damage of plasma.
[0009] moreover, while acquiring the homogeneity of the electric field effect to a processed substrate, in order to reinforce an adsorption effect with combined use of an electrostatic chuck and to plan the prolongation-of-life effect of the life of an electrostatic chuck further, it is necessary to solve problems, such as transformation of the heterogeneity of the electric field effect, accumulation, and the material itself, a low etching rate, the heterogeneity of a temperature effect, the heterogeneity of an etching rate, electric damage prevention to the material itself, and electrostatic Chuck's short life
[0010] Furthermore, you also have to take into consideration exclusion of the factor which will make control of the quality of a precise manufacture impossible by the detailed pattern in the future. this invention is offered for the purpose of developing the suitable method which solves many above problems.

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[0011]
[Means for Solving the Problem] Drawing 1 is principle explanatory drawing of this invention. For 1, as for a substrate electrode holder and 3, in drawing, a processed substrate and 2 are [an evacuation pipe and 4] electrostatic chucks.
[0012] By this invention, when performing a gas cooling method, on the occasion of vacuum adsorption fixation in the substrate electrode holder 2 of the processed substrate 1, adsorption fixation of the degree of vacuum of adsorption fixation is carried out above 10-4 to which plasma generating does not take place - near 10-5Torr so that plasma may not occur. That is, the degree region of high vacuum outside [which can be plasma generated] a field is used.
[0013] And if combined use adsorption fixation with the electrostatic chuck 4 is performed, it will become possible to give still more positive stability. In order to carry out the state which the processed substrate 1 which is a charge of an adsorption bridging does not heat at this time, or a temperature control, the function in which a temperature control is possible is given to the adsorption side of the substrate electrode holder 2 which touches the processed substrate 1.
[0014] namely, evacuation pipe 3 formed in the substrate electrode holder 2 as the purpose of this invention was the fixed method of the processed substrate 1 in plasma treatment equipment and it was shown in drawing 1 Tooth back of this processed substrate 1, carrying out adsorption maintenance in the degree of vacuum field which plasma does not generate -- moreover, vacuum adsorption maintenance of the aforementioned processed substrate 1 -- in addition It is attained by using the electrostatic chuck 4 together.
[0015]
[Function] With this invention It becomes the effectiveness to etching, and the hook of increase in efficiency to prevent that plasma turns to an adsorption fixed side and the tooth back of a processed substrate.
[0016] therefore, the degree of vacuum of the adsorption fixation by the vacuum -- field of the degree 10-4 of high vacuum besides a plasma generating area - 10-5Torr or -- if adsorption fixation is carried out with the degree of vacuum beyond it Plasma does not turn to between a processed substrate and a substrate electrode holder. furthermore If an electrostatic chuck is used together and used The homogeneity of the electric field effect is acquired.
[0017]
[Example] Drawing 2 is explanatory drawing of one example of this invention. drawing -- setting -- 1 -- a processed substrate and 2 -- a substrate electrode holder and 3 -- an evacuation pipe and 4 -- an electrostatic chuck and 5 -- a chamber and 6 -- a lid and 7 -- an O ring and 8 -- a gas shower and 9 -- a quartz ring and 10 -- plasma -- 11 -- counterelectrode (gas introduction board) 12 is an electrode substrate electrode holder.
[0018] Drawing 2 explains one example of this invention. Plasma etching of the aluminum (aluminum) film on a wafer is carried out using a silicon wafer as a processed substrate 1.
[0019] They are chlorine (Cl2) 60sccm and boron-trichloride (BCl3) 100sccm as etching gas. It introduces through the gas shower 8 in a chamber 5. As conditions for plasma etching, it is degree of vacuum 0.06Torr in a chamber 8. Frequency of 13.56MHz Output aluminum film was etched by 250-300W.
[0020] For etching, unless it is the degree of vacuum of 10-2 - 10-3Torr, plasma does not arise. The vacuum pump for adsorption fixation is a rotary pump or a dry pump. It reaches. It carries out using a turbine pump. and The degree of high vacuum of the 10-4 - near 10-5Torr where, as for the degree of vacuum under adsorption fixation of the processed substrate 1, plasma generating does not take place, Or adsorption fixation is carried out with the degree of high vacuum beyond it. moreover Combined use with the electrostatic chuck 4, The distribution of the adsorption fixed force is equalized. Thermolysis is made smooth.
[0021]
[Effect of the Invention] as [explained / above] According to this invention Improvement of an etching distribution, the improvement of the throughput by improvement in the speed of etching and the reduction effect of a manufacture obstacle are remarkable, and reinforcement of the cost cut by reduction of operating capacity and an electrostatic chuck is attained, and it contributes to upgrading of a semiconductor device, and yield reservation -- a place is large

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] processed substrate in plasma treatment equipment (1) the fixed method -- it is -- substrate electrode holder (2) Evacuation pipe (3) formed inside ****** This processed substrate (1) The plasma treatment equipment substrate fixed method characterized by carrying out adsorption maintenance of the tooth back in the degree of vacuum field which plasma does not generate.
[Claim 2] The aforementioned processed substrate (1) It adds to vacuum adsorption maintenance. Electrostatic chuck (4) The plasma treatment equipment processed substrate fixed method according to claim 1 characterized by using together.

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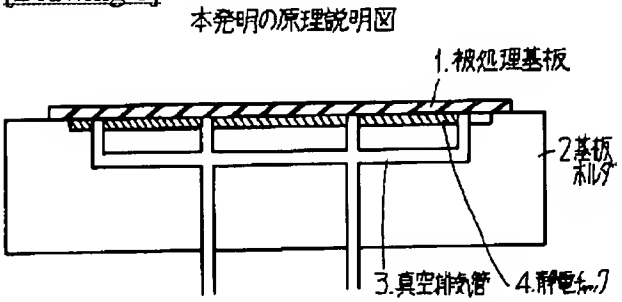
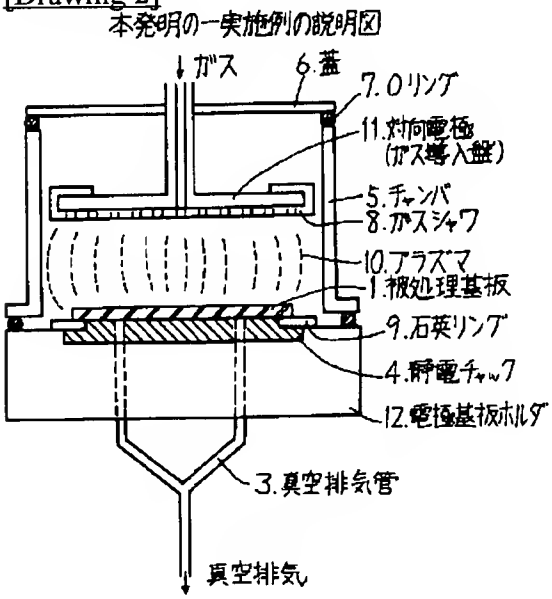
DRAWINGS

[Drawing 1]



[Drawing 2]



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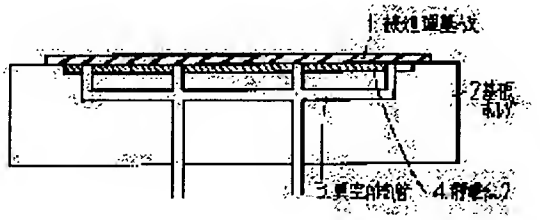

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	21/68	P	8418－４M		
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(71)出願人　000005223
富士通株式会社
神奈川県川崎市中原区上小田中1015番地

(72)発明者　藤川　道夫
神奈川県川崎市中原区上小田中1015番地
富士通株式会社内

(74)代理人　弁理士　井桁　貞一

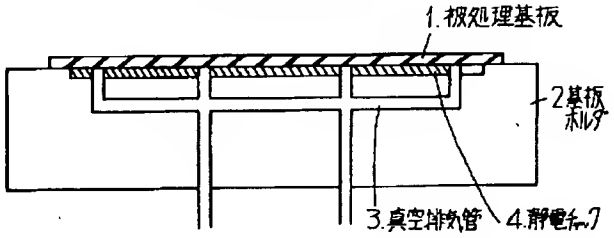
(54)【発明の名称】プラズマ処理装置被処理基板固定方法

(57)【要約】

【目的】　本発明は，プラズマ処理装置内の被処理基板の固定方法に関し，プラズマ処理中に，発生したプラズマが被処理基板の背面に回り込まない方法を得ることを目的とする。

【構成】　基板ホルダ２内に設けた真空排気管３により，該被処理基板１の背面を，プラズマが発生しない真空度領域で吸着保持するように，また，真空吸着保持に加えて，静電チャック４を併用するように構成する。

本発明の原理説明図



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【特許請求の範囲】

【請求項１】　プラズマ処理装置内の被処理基板(1) の固定方法であって、基板ホルダ(2) 内に設けた真空排気管(3) により，該被処理基板(1) の背面を，プラズマが発生しない真空度領域で吸着保持することを特徴とするプラズマ処理装置基板固定方法。

【請求項２】　前記被処理基板(1) の真空吸着保持に加えて，静電チャック(4) を併用することを特徴とする請求項１記載のプラズマ処理装置被処理基板固定方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は，プラズマ処理装置内の被処理基板の固定方法に関する。近年，ＬＳＩの高集積化，微細化の要求にともない，ドライエッチング技術全般の向上が必要となってくる。

【０００２】そのため，プラズマ処理装置内の被処理基板の固定方法においても，その基板へのプラズマの影響を考慮した対策が必要となる。

【０００３】

【従来の技術】従来のプラズマ反応室等，真空中の被処理基板の固定方法は，当初機械式固定方法が用いられていたが，被固定物である被処理基板と，吸着固定面である電極固定面の固定力に不均衡が生じ易く，従って，被固定物と吸着固定面間に隙間が生じて，プラズマが侵入し，レジスト膜の焦げ，パターン異常，加工精度の不安定等の発熱や蓄熱による悪影響がある。

【０００４】また，エッチングレートやアッシングレート，或いは膜のエッチング形状に対して，電界効果など，制御分布の不均一を生じ，更に，電気特性にダメージを与える。

【０００５】そのため，静電チャック固定方式が開発され，更に被処理基板の冷却を行うためのガス冷却方式と静電チャック方式を併用した固定方法が用いられるようになった。

【０００６】これらの固定方法は，機械式固定方法よりは，被固定物と吸着固定面間の固定力が改善されているが，固定方式において，静電チャックによる吸着力と，ガス冷却による離力が働き，相反する力から成り立つ方式であるため，静電チャックの寿命が短く，被処理基板の離脱やレジスト膜の焦げ，特性のダメージがしばしば多発する。

【０００７】また，静電チャックの短命はプラズマのダメージによるものである。この為，プラズマの被処理基板への回り込みは特に近い将来の課題でもある微細パターンの制御性を重視するプロセス条件の発展への大きな阻害要因になる。

【０００８】

【発明が解決しようとする課題】従って，プラズマが発振しない領域での真空吸着で被固定物と吸着固定面間へのプラズマの侵入を阻止し，プラズマの物理化学的，或

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いは電気的ダメージ等の弊害を取り除く必要がある。

【０００９】また，被処理基板への電界効果の均一性を得るとともに，静電チャックの併用で吸着効果を補強し，更に静電チャックの寿命の延命効果を図るため，電界効果の不均一性，蓄熱，材料自身の変質，低いエッチングレート，温度効果の不均一性，エッチングレートの不均一性，材料自身への電気的ダメージ防止，静電チャックの短命等の問題を解決する必要がある。

【００１０】更に，将来的に微細パターンで緻密な製造物の品質の制御を不可能にする要因の排除も考慮せねばならぬ。本発明は，以上の諸問題を解決する適切なる方式を開発することを目的として提供されるものである。

【００１１】

【課題を解決するための手段】図１は本発明の原理説明図である。図において，１は被処理基板，２は基板ホルダ，３は真空排気管，４は静電チャックである。

【００１２】本発明では，ガス冷却を行う場合に，被処理基板１の基板ホルダ２への真空吸着固定に際して，プラズマが発生しない様に，吸着固定の真空度をプラズマ発生が起こらない10^{-4}～10^{-5}Torr付近以上で吸着固定する。つまりプラズマ発生可能領域外の高真空度域を使用する。

【００１３】そして，静電チャック４との併用吸着固定を行えば，更に確実な安定性を持たせることが可能となる。この時，吸着固定材料である被処理基板１が加熱しない状態，または温度コントロールをするため，被処理基板１と接する基板ホルダ２の吸着面に温度制御が可能な機能をもたせる。

【００１４】即ち，本発明の目的は，プラズマ処理装置内の被処理基板１の固定方法であって，図１に示すように，基板ホルダ２内に設けた真空排気管３により，該被処理基板１の背面を，プラズマが発生しない真空度領域で吸着保持することにより，また，前記被処理基板１の真空吸着保持に加えて，静電チャック４を併用することにより達成される。

【００１５】

【作用】本発明では，プラズマが吸着固定面，及び被処理基板の背面へ回り込むことを阻止することが，エッチングへの有効性，効率化のかぎとなる。

【００１６】そのため，真空による吸着固定の真空度をプラズマ発生域外の高真空度10^{-4}～10^{-5}Torrの領域，またはそれ以上の真空度で吸着固定すると，被処理基板と基板ホルダ間へプラズマが回り込まない。更に，静電チャックを併用して使用すると，電界効果の均一性が得られる。

【００１７】

【実施例】図２は本発明の一実施例の説明図である。図において，１は被処理基板，２は基板ホルダ，３は真空排気管，４は静電チャック，５はチャンバ，６は蓋，７はＯリング，８はガスシャワ，９は石英リング，10はプ

ラズマ，11は対向電極（ガス導入盤），12は電極基板ホルダである。

【００１８】図２により本発明の一実施例について説明する。被処理基板１としてシリコンウエハを用い，ウエハ上のアルミニウム(Al)膜をプラズマエッチングする。

【００１９】エッチングガスとして塩素(Cl_2)60sccm，三塩化硼素(BCl_3)100sccm をチャンバ５内にガスシャワ８を介して導入する。プラズマエッチングの条件として，チャンバ８内の真空度0.06Torr，周波数13.56MHz，出力250～300 WでAl膜のエッチングを行った。

【００２０】エッチングのためには，10^{-2}～10^{-3}Torrの真空度でないとプラズマが生じない。吸着固定用の真空ポンプはロータリーポンプまたはドライポンプ，及び，ターボポンプを用いて行う。そして，被処理基板１の吸着固定中の真空度はプラズマ発生が起こらない10^{-4}～10^{-5}Torr付近の高真空度，或いはそれ以上の高真空度で吸着固定をしている。また，静電チャック４との併用で，より吸着固定力の分布を均一化し，放熱をスムーズにしている。

【００２１】

【発明の効果】以上説明したように，本発明によれば，

エッチング分布の改善，エッチングの高速化によるスループットの改善，製造障害の減少効果が著しく，また使用ガス量の減少によるコストダウン，静電チャックの長寿命化が図られ，半導体素子の品質向上，歩留り確保に寄与するところが大きい。

【図面の簡単な説明】

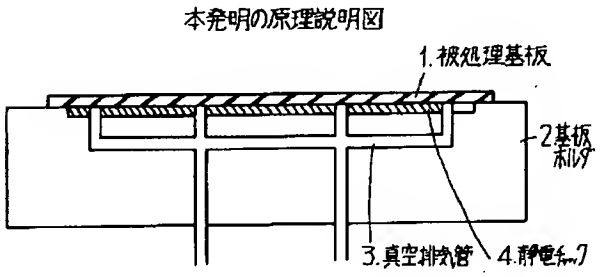
【図１】　本発明の原理説明図

【図２】　本発明の一実施例の説明図

【符号の説明】

1　被処理基板
2　基板ホルダ
3　真空排気管
4　静電チャック
5　チャンバ
6　蓋
7　Ｏリング
8　ガスシャワ
9　石英リング
10　プラズマ
11　対向電極（ガス導入盤）
12　電極基板ホルダ

【図１】



【図２】